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CHEMICAL & ENGINEERING

NEWS

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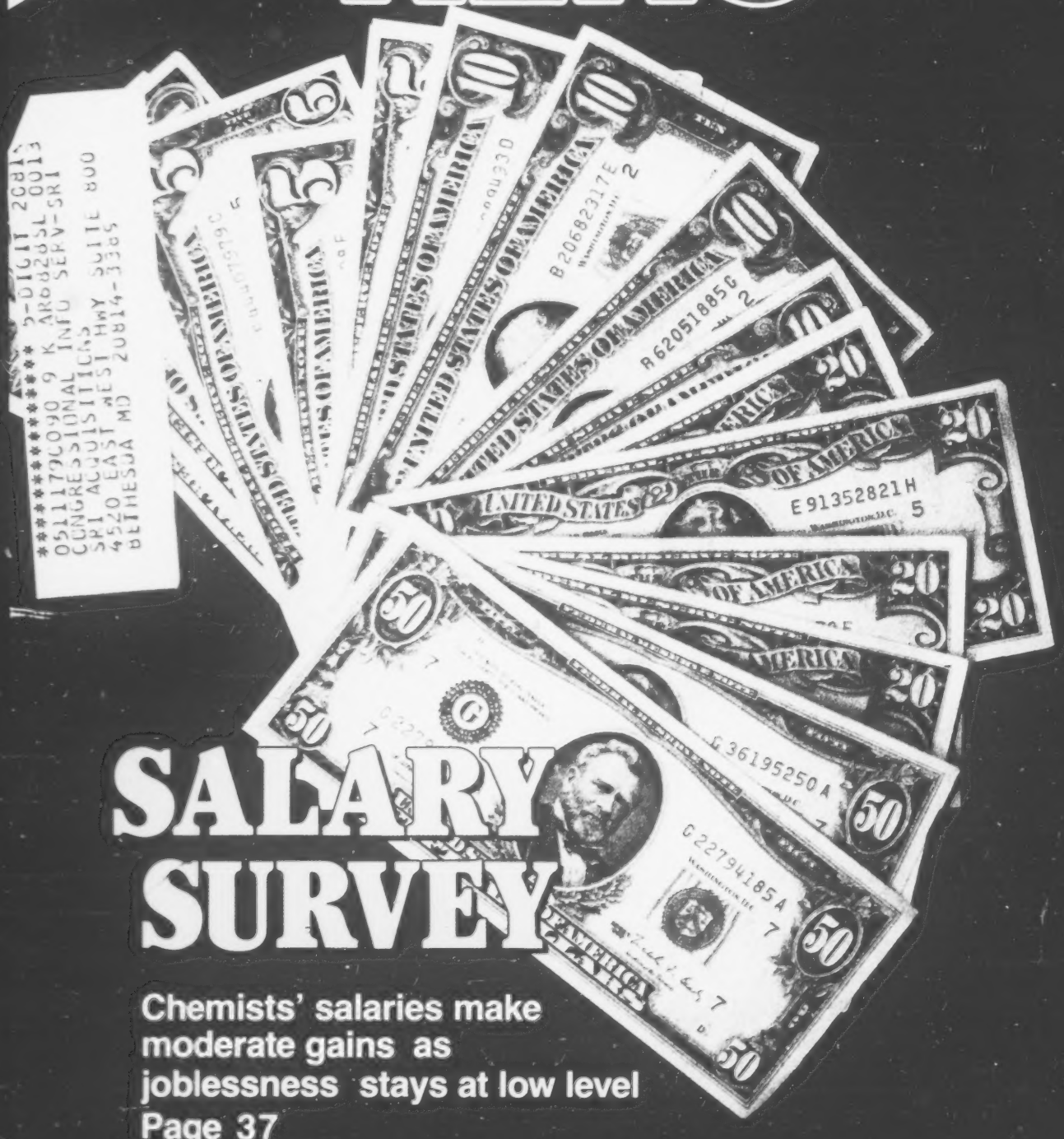
FINAL PROGRAM
ACS national meeting in
Washington, D.C. Page 43



SALARY SURVEY

Chemists' salaries make moderate gains as joblessness stays at low level
Page 37

CHEMICAL & ENGINEERING
NEWS
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News of the Week

■ **Ministers from nearly 100 countries at recent UN-sponsored meeting agree to actions to stem ozone depletion, including setting up a fund to aid developing nations in their use of alternative chemicals, technologies.** Page 6

■ **Paint makers voluntarily agree to stop mercurial biocides use in interior latex paints.** Page 7

■ **Cost projections for Department of Energy cleanup of its nuclear arms complex will be higher than originally estimated.** Page 7

■ **Federal Trade Commission announces it is contesting two chemical acquisitions.** Page 8

■ **Georgian Democrat, Sen. Sam Nunn, calls on colleagues to employ defense establishment's know-how in efforts to help halt the destruction of the environment.** Page 8

News Focus

FDA recommendations on chiral drugs marketed as racemates are unlikely to demand stereoisomeric purity in all cases. **Page 9**

Business

Plastics recycling is on the increase as more companies find that reusing plastics is both good business and good public relations. **Page 19**

Government

Hearings on legislation that would create a civilian technology agency find much support for proposal among witnesses called to testify. **Page 24**

House begins to move on 1991 appropriation bills, deals first with multibillion dollar Department of Energy bill. **Page 25**

Science/Technology

Oligonucleotide agent cleaves yeast chromosome DNA at target sites in the presence of the almost 14 million base pairs of DNA that comprise the yeast genome. **Page 32**

Proposals for two anti-AIDS projects are being sought by National Cancer Institute from potential contractors. **Page 33**

Final Program

200th ACS national meeting in Boston in August will consist of more than 4000 papers, numerous social events, and an exposition. **Page 43**

Salary Survey

The unemployment rate for U.S. chemists, at 1.1% last March, remains low for the fourth year straight, ACS survey shows. Median salaries, meanwhile, are 5% higher than a year earlier, about in line with inflation. **Page 37**

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Chemical & Engineering News
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LETTERS

CHEMICAL SAFETY

Methylene chloride extraction

We would like to relate a potentially hazardous experience involving solvent extraction of water samples using separatory funnel technique. The procedure involved a methylene chloride extraction for the determination of PCBs in water samples and is similar to an incident reported by R. E. Kelling (C&EN, April 30, page 2).

Specifically, two occasions occurred where the glass stopper of the 2-L separatory funnel was violently ejected. The first episode occurred immediately following the addition of 60 mL of methylene chloride to a 1-L sample of water (pH approximately 6). The funnel was placed upright in a ring stand with the stopper inserted and swirled once in the upright position. Before any shaking or inverting, the glass stopper was violently shot upward. This occurred in a hood and fortunately resulted in no injuries.

The second incident involved a similar ejection of the glass stopper from the separatory funnel. This time, however, it occurred several minutes after proper extraction procedure had begun. This time the glass stopper struck the student in the arm and side with enough force to cause a significant bruise—and she was holding the stopper in place with the palm of her hand!

We were carrying out published procedures (EPA method 608) for the environmental analysis of water samples and no unusual events or circumstances were noted that would account for our experiences. Given the similarity of the hazards recently reported for methylene chloride extraction, it is urged that extreme safety precautions be taken when performing these types of experiments.

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Magic or science?

Gordon Barrow, in his letter (C&EN, April 9, page 2), is correct in his observation that a root of the sorry state of chemical education is the general chemistry course, and that only radical change will remedy the present "well-entrenched, ineffective presentation." I recently ran across a telling example of just what's wrong. The authors of an article discussing significant figures presented two alternative procedures. They then opted for the one that by their admission was more arbitrary and harder to justify, even to students, on the basis that "many students (especially at the freshman level), are not yet capable of this level of understanding (or cannot be motivated to achieve it) and must necessarily memorize magic formulas."

How have we come to be teaching magic, rather than science? Because magic is easier. It meets the goals of both students and teachers. To most of our students, chemistry is just part of a professional initiation ritual. They want a set of incantations that will get them an acceptable grade. This is what they've always gotten, under the title of "higher reasoning skills"—the current slogan for slighting the fundamentals. They certainly don't want rigor or uncertainty. Most of their teachers are likewise addicted to the status quo. They want what gets them back to their labs and grant applications with the least fuss or threat to their standing on the student popularity polls titled "teaching evaluation instruments." Especially to be avoided is anything hard enough that it brings students to their offices! Text authors and publishers can't be blamed if they give both teachers and students what they want.

The general chemistry course we badly need is one that attempts far less, and does it far better. If our typical student is unprepared to handle the math of, for example, relative precision, how can that student understand the second law of thermodynamics? We've got to quit supplying answers until students can understand the questions. We need to cover less, so that we can uncover, and our students can discover, a lot more. Some of them may then choose chemistry as a career for the only right rea-

As Unemployment Stays Very Low, Salaries Improve Moderately

The economic well-being of U.S. chemists appears basically favorable this year. Salaries continue to rise at a moderate clip. And as of last March, only 1.1% of chemists were without a job but looking for one, the annual survey of the economic status of U.S. members of the American Chemical Society indicates.

That makes 1990 the fourth year running that unemployment in the profession has hovered close to 1%, the longest such streak of low-level joblessness since ACS began collecting data of this type in 1971. Like last year, moreover, the rate of unemployment is about the same for chemists across the board, whether they are men or women, whatever their highest academic degree, and whether or not they are members of a racial minority. And this year's rate is considerably below the 5.2% unemployment rate last March for the U.S. civilian labor force as a whole, or even the 1.8% rate for all managerial and professional employees.

About half the chemists unemployed but seeking jobs last March report that they place no restrictions on their search for new work, but about a fourth note that their inability to relocate limits their success; other restrictions, such as family responsibilities or the need for part-time work, affected relatively few. Of the 1.4% of chemists employed only part-time, more than a third are doing so out of choice. Family restraints limit an additional 23% to part-time work.

Some other highlights from this year's survey, which also are in line with findings of previous surveys: Chemists working in private industry tend to earn more than their colleagues in the academic world or in government, with the highest base salaries going to those who have managerial responsibilities; the gap between men's salaries and those earned by women persists essentially unchanged; chemists are satisfied by and large with what they are paid, with their opportunities for promotion, and with their jobs in general.

Growth in salaries earned by chemists continues to be moderate. The median base salary at all degree levels, as of March 1, is 5% higher than the median reported last year. (The median is the salary that is exceeded by 50% of the survey respondents; because it is not affected by a few extremely high or low cases, the median reflects more accurately than the mean the typical salary for a given group of individuals.) The annual rate of increase in salaries

Employment differs little among ACS members whatever their gender, education, or background

	Chemists									
		By sex		By highest degree			By minority status		Chemical engineers	All members[c]
Employment status[a]	Total	Men	Women	B.S.	M.S.	Ph.D.	Minority[b]	Nonminority		
Employed full time	94.1%	95.1%	89.8%	95.6%	95.3%	93.2%	91.6%	94.4%	95.4%	94.2%
Employed part time	1.4	0.9	3.8	1.5	1.8	1.3	0.9	1.5	1.6	1.5
Postdoctoral or fellowship	2.2	2.1	2.8	0.1	0.1	3.8	5.6	1.9	0.5	2.1
Unemployed										
Seeking employment	1.1	1.1	1.2	1.2	1.2	1.0	1.2	1.1	1.0	1.1
Not seeking employment	1.1	0.8	2.4	1.7	1.6	0.8	0.6	1.2	1.5	1.2

a As of March 1, 1990. b Black, Spanish/Hispanic, American Indian, Alaskan native, Asian, Pacific Islander, or other. c Includes ACS members whose highest degree and present work are in neither chemistry or chemical engineering. **Source:** ACS survey

Rate of growth for chemists' salaries held steady during the past decade

												Annual change		
$ Thousands	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1989–90	1985–90	1980–90
CHEMISTS' MEDIAN SALARIES[a]														
B.S.	$39.0	$37.0	$35.4	$33.5	$33.0	$32.0	$30.9	$30.0	$28.5	$27.5	$25.0	5%	4%	5%
M.S.	45.0	43.0	41.0	39.0	37.9	36.0	34.0	33.0	31.6	30.0	26.0	5	5	6
Ph.D.	55.0	52.5	50.0	47.7	47.8	44.0	42.0	40.0	37.5	35.0	31.2	5	5	6
All chemists	49.8	47.3	45.0	42.5	42.5	40.0	38.0	36.0	34.7	32.0	28.9	5	4	6

a Base annual salary of chemists employed full time as of March 1. **Source:** ACS survey

Salaries increase more moderately for chemists during the latter part of their career

Median salary ($ thousands)[a]	Years since B.S. degree										
	0 to 1	2 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Overall
NONACADEMIC CHEMISTS											
B.S.											
90%	$34.0	$35.5	$44.0	$54.0	$64.0	$71.0	$ 75.0	$ 80.0	$ 82.0	$ 96.0	$64.0
75%	30.0	32.0	38.9	46.8	52.1	60.0	63.0	65.0	66.0	73.0	50.0
50%	27.0	28.6	34.0	40.0	44.0	49.0	51.5	55.0	55.0	58.0	39.0
25%	23.5	25.0	29.5	34.0	37.0	40.2	42.0	45.0	44.2	46.4	31.2
10%	20.0	22.0	25.3	29.5	32.0	34.5	33.5	37.0	36.9	36.0	26.0
M.S.											
90%	—	36.5	45.0	55.5	63.0	70.1	79.0	80.0	81.5	90.0	70.0
75%	—	35.0	40.0	49.0	55.0	61.0	65.0	68.4	70.0	72.8	57.0
50%	—	33.0	36.0	42.5	47.0	51.0	54.0	57.0	59.0	62.0	46.0
25%	—	29.4	32.0	37.2	40.0	43.0	45.2	46.2	47.1	50.0	38.0
10%	—	25.0	27.8	32.0	35.0	36.0	38.9	38.3	40.0	40.0	32.0
Ph.D.											
90%	—	—	52.5	63.0	75.0	87.0	100.0	103.0	110.0	105.0	88.0
75%	—	—	49.8	57.0	65.0	74.2	80.5	84.0	88.0	85.1	72.0
50%	—	—	46.5	51.0	58.0	63.5	68.4	70.0	73.0	72.0	60.0
25%	—	—	43.5	46.2	51.0	54.8	58.0	59.1	60.0	60.0	50.0
10%	—	—	40.0	42.0	44.0	47.0	49.0	50.0	51.0	50.0	44.0

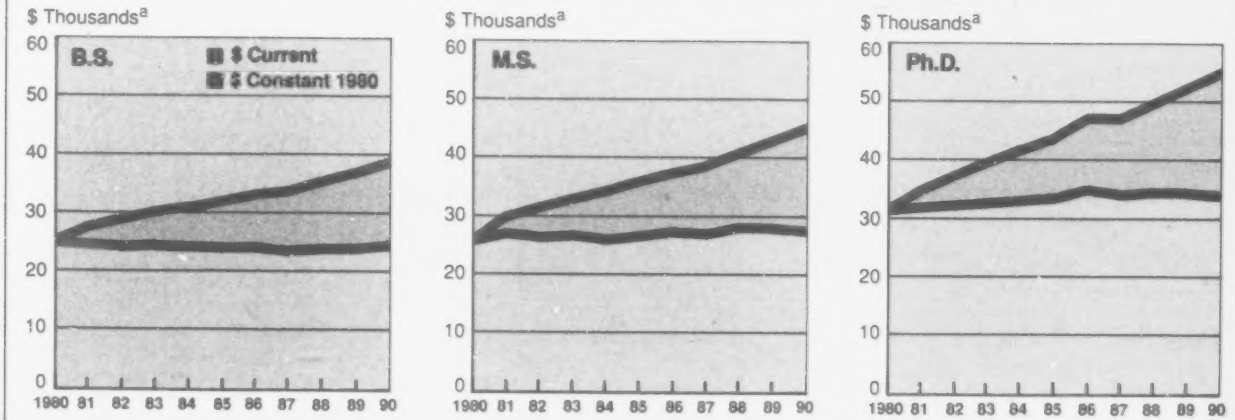
How to read this table: Using, as an example, nonacademic B.S. chemists two to four years after they have received their B.S. degree, 90% of these chemists have annual base salaries of $35,500 or less, 75% have annual base salaries of $32,000 or less, 50% have annual base salaries of $28,600 or less, 25% have annual base salaries of $25,000 or less, and 10% have annual base salaries of $22,000 or less, as of March 1, 1990. a As of March 1, 1990. **Source:** ACS survey

has averaged about the same for more than a decade.

As has been true throughout the 1980s, however, the increase in these medians has done little more than keep pace with the rise in consumer prices. After adjustment for inflation, in fact, the median salary for chemists whose highest degree is a B.S. is 3% lower than what it was 10 years ago. Those with graduate degrees are a little better off, but not much; in constant dollars, the median for chemists with an M.S. is up 8% from 1980, that for chemists with a Ph.D. is 10% higher. Even so, chemists' salaries have fared better during the past decade than they did during the 1970s, when, after factoring in inflation, they actually fell significantly.

The overall median, of course, provides only a very rough measure of typical salaries. What individuals actually earn depends also, for example, on the length of their career, the type of work they do, and whom they work for. When length of career is considered, individuals are likely to have more to show in terms of inflation-adjusted earnings than the overall medians might suggest. Thus, if they earned at the median, recently graduated Ph.D. chemists in nonacademic jobs five years ago would have had a salary of about $38,000. This year, the median for these Ph.D. chemists, now after five additional years of experience, is

Although chemists' salaries keep rising, the increases have been largely offset by inflation



a Median base annual salary for chemists employed full time as of March 1 of each year. **Source:** ACS survey

Salaries are highest for Ph.D. chemists in the oil industry

Industry	% of industrial chemists: All chemists	B.S.	M.S.	Ph.D.	Mean salary ($ thousands)[a]: B.S.	M.S.	Ph.D.
Petroleum and natural gas	4%	4%	4%	5%	$48.4	$56.5	$71.3
Pharmaceuticals[b]	19	17	21	19	44.0	52.1	69.8
Electronics	4	3	3	4	45.6	51.8	67.2
Biochemical products	2	1	2	2	42.8	51.2	66.8
Plastics	5	4	5	6	45.6	53.8	66.3
Food	3	4	4	3	43.4	51.8	65.6
Basic chemicals	6	4	5	8	45.9	53.5	65.6
Specialty chemicals	15	14	13	17	44.8	52.9	64.8
Agricultural chemicals	4	3	4	5	41.7	48.7	63.6
Soaps and detergents	1	2	1	1	45.9	53.3	63.5
Aerospace	3	2	3	3	46.8	54.4	63.3
Metals and minerals	2	3	2	1	40.7	50.6	62.2
Coatings and ink	4	6	5	3	44.5	51.6	61.2
Rubber	2	3	2	1	44.8	53.3	60.5
Paper	1	1	1	1	42.1	56.8	60.4
Other manufacturing	13	14	13	12	42.2	53.2	65.1
Nonmanufacturing	11	15	13	9	43.4	52.7	63.4

a As of March 1, 1990; to facilitate comparison, mean salaries are adjusted for differences in average length of experience for each group. b Includes personal care products. Source: ACS survey

$51,000. After adjustment for rising prices during the past five years, that amounts to a real increase of 11%.

Gender continues to be a factor in the level of chemists' salaries. One reason is that women, as a group, tend to be less experienced than men as a group. Nearly half the men chemists working in industry received their B.S. degree 20 or more years ago; only about a fifth of the women did so.

Even when salaries are adjusted for differences in age distribution between the two sexes, however, men have a distinct salary advantage. Men's average salaries (the average rather than the median is used in making the age adjustment) are roughly 10 to 20% higher than the average for women, whether the comparison is between chemists working in industry or academia, for the government, or elsewhere—although the gap is narrowest for government employees. The gap, moreover, has shown no sign of closing appreciably in recent years.

Also as in the past, the difference between men's and women's salaries is slight among chemists who are relatively early in their career—about 5% or less for chemists employed in industry who obtained their B.S. less than 10 years ago. But it widens appreciably for more experienced chemists. The median salary for

Chemists teaching in Ph.D.-granting departments have higher salaries

Median salary ($ thousands)[a]	Years since B.S. degree: 5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Overall
PH.D. CHEMISTS EMPLOYED FULL TIME IN ACADEMIA									
Ph.D.-granting departments									
Professor	—	($ 64.1)	$ 65.1	$ 68.8	$ 72.0	$ 73.2	$ 73.2	$ 77.2	$72.5
Associate professor	—	48.8	51.2	51.2	52.0	52.5	51.4	52.0	51.2
Assistant professor	$ 42.7	42.7	42.0	44.5	—	—	—	—	42.5
Instructor or lecturer	(27.8)	(34.0)	36.0	(39.6)	(40.8)	(45.0)	(43.9)	—	35.0
Research associate	24.9	33.0	40.0	45.0	40.0	(39.0)	(57.1)	—	35.0
All ranks[b]	37.8	42.5	46.6	56.9	64.8	68.0	69.5	73.3	57.1
Non-Ph.D.-granting departments									
Professor	—	—	48.8	52.5	54.9	59.8	58.6	62.2	57.1
Associate professor	—	40.3	41.6	44.5	44.2	48.5	50.0	(45.7)	44.0
Assistant professor	34.2	36.6	36.6	37.0	36.6	(41.2)	—	—	36.5
Instructor or lecturer	(33.2)	(31.1)	(35.5)	(34.5)	(33.4)	—	—	—	34.0
Research associate	—	33.6	(31.3)	(35.0)	—	—	—	—	34.5
All ranks[b]	34.2	36.6	39.0	45.1	51.2	56.0	56.7	60.0	48.5

Note: Where no salary data are shown, sample is too small to provide a meaningful figure; data in parentheses are from relatively small samples, as well, and should be viewed with caution. a Best annual salary as of March 1, 1990, excluding summer teaching and other supplemental earnings; salaries of the approximately 60% of academic chemists who have nine- or 10-month contracts are adjusted to a 12-month basis. b Includes unranked faculty and others not listed separately. Source: ACS survey

Women chemists' salaries typically are 10 to 20% lower than their male colleagues'

Mean salary ($ thousands)[a]	B.S.: All chemists	Men	Women	Women as % of men	M.S.: All chemists	Men	Women	Women as % of men	Ph.D.: All chemists	Men	Women	Women as % of men
EMPLOYER												
Private industry	$43.6	$46.4	$39.7	86%	$50.5	$52.4	$46.6	89%	$65.1	$66.2	$58.8	89%
Academic	30.4	33.1	25.5	77	36.0	38.7	32.2	83	49.1	50.5	42.6	84
Government	39.2	40.9	37.1	91	43.9	45.1	42.7	95	56.0	57.0	50.8	89
Other	43.3	46.2	36.5	79	48.3	51.0	44.0	86	64.4	66.0	55.5	84

a As of March 1, 1990; to facilitate comparison, women's salaries are adjusted for the difference in average length of experience between them and men. Source: ACS survey

In industry, chemists tend to earn highest salaries in management and marketing jobs

Median salary ($ thousands)[a]		Years since B.S. degree										
		0 to 1	2 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 or more	Overall
CHEMISTS EMPLOYED FULL TIME IN INDUSTRY												
Sex												
Men	B.S.	$ 27.3	$ 29.4	$ 35.0	$ 41.5	$ 45.7	$ 50.0	$ 54.6	$ 56.3	$ 57.0	$ 60.0	$ 42.1
	M.S.	—	33.5	36.8	43.5	48.8	53.0	56.0	60.0	61.2	62.0	49.8
	Ph.D.	—	—	47.0	52.0	59.2	65.4	72.0	73.0	76.0	75.0	60.9
Women	B.S.	26.5	29.0	33.0	37.5	41.3	44.9	41.6	43.8	44.3	(53.0)	34.0
	M.S.	—	33.0	35.6	43.0	46.0	48.0	46.3	45.0	51.0	(50.0)	41.0
	Ph.D.	—	—	46.5	50.3	58.0	60.0	60.0	60.0	62.0	(69.6)	51.5
Work function												
General management	B.S.	—	34.5	36.0	45.0	52.8	63.5	66.5	71.0	64.0	80.0	51.0
	M.S.	—	—	39.1	45.6	53.2	70.0	60.9	72.0	(74.6)	85.0	58.2
	Ph.D.	—	—	(47.5)	58.7	65.0	78.0	85.5	89.1	88.9	100.0	78.8
R&D management	B.S.	—	(34.5)	42.0	48.5	58.0	62.1	69.0	67.0	70.0	65.0	59.2
	M.S.	—	—	35.2	52.0	55.5	64.2	66.0	68.5	75.0	64.0	60.0
	Ph.D.	—	—	50.0	59.0	66.7	74.0	80.0	86.2	91.0	90.0	75.0
Basic research	B.S.	28.0	29.0	32.5	37.5	42.5	(46.4)	(46.9)	(53.0)	—	—	32.5
	M.S.	—	34.0	36.0	40.0	45.4	51.5	52.0	(53.0)	(67.7)	—	42.0
	Ph.D	—	—	47.8	52.0	58.0	62.6	70.0	70.0	78.0	78.0	55.0
Applied research[b]	B.S.	26.3	29.9	34.8	39.6	43.2	48.0	50.2	52.0	55.2	52.0	37.7
	M.S.	—	33.5	36.5	42.4	47.5	49.1	52.7	57.2	55.0	60.1	45.0
	Ph.D.	—	—	46.5	50.1	56.0	60.1	65.0	65.4	67.8	67.0	55.0
Production[c]	B.S.	27.3	27.6	32.4	38.2	41.0	45.0	48.3	49.7	48.0	43.1	36.5
	M.S.	—	32.0	34.8	42.0	42.5	48.0	51.1	51.9	46.5	(45.0)	42.5
	Ph.D.	—	—	44.8	48.1	55.0	59.5	60.0	(70.0)	57.5	(62.4)	55.0
Marketing[d]	B.S.	(29.1)	31.0	37.8	44.0	49.9	59.0	54.8	54.5	56.1	60.0	45.0
	M.S.	—	—	38.5	46.0	54.5	56.1	57.0	58.2	55.5	60.0	52.0
	Ph.D.	—	—	(44.0)	50.6	60.0	64.3	69.5	67.0	66.4	(70.0)	61.0
Work specialty												
Agricultural and food chemistry	B.S.	—	26.2	33.3	35.9	44.5	47.8	(48.0)	(50.8)	(55.2)	—	35.9
	M.S.	—	—	(36.2)	43.5	45.9	53.6	(70.0)	(60.0)	(62.0)	(59.0)	48.0
	Ph.D.	—	—	45.7	49.0	58.0	61.4	69.1	74.5	84.1	(83.5)	59.0
Analytical chemistry	B.S.	26.1	28.6	33.0	38.8	42.7	47.3	48.4	50.8	50.0	52.0	37.5
	M.S.	—	30.4	35.0	42.3	46.0	50.0	51.0	54.0	56.2	60.1	44.1
	Ph.D.	—	—	46.0	51.2	58.0	62.0	65.4	67.1	68.0	67.2	56.0
Biochemistry	B.S.	—	30.0	31.0	(39.6)	(46.1)	—	—	—	—	—	35.1
	M.S.	—	—	(35.0)	38.5	(42.5)	(52.0)	(49.0)	—	—	—	42.0
	Ph.D.	—	—	(47.0)	51.5	57.0	60.5	68.9	(72.0)	82.9	(79.5)	58.2
Biotechnology	B.S.	—	29.2	33.0	(44.0)	(50.0)	—	—	—	—	—	34.9
	M.S.	—	—	38.0	43.3	44.0	(48.8)	—	—	—	—	44.0
	Ph.D.	—	—	46.2	55.0	59.0	70.2	73.0	83.0	(79.6)	—	60.0
Environmental chemistry	B.S.	25.0	28.0	34.0	42.4	46.5	48.2	49.5	56.5	60.0	—	37.9
	M.S.	—	(32.6)	38.0	43.5	48.0	50.0	(54.8)	(53.0)	(59.8)	(60.0)	45.0
	Ph.D.	—	—	43.1	48.5	57.0	63.0	67.0	75.0	64.8	(72.0)	61.7
Inorganic chemistry	B.S.	(26.0)	(28.0)	35.0	36.2	(41.2)	(52.0)	(46.0)	(54.6)	(61.0)	(53.5)	40.8
	M.S.	—	—	—	(48.8)	(51.2)	(50.0)	(56.3)	(60.4)	—	(55.0)	(50.9)
	Ph.D.	—	—	46.0	52.0	57.7	60.0	70.0	69.0	78.0	72.7	57.1
Materials science	B.S.	—	32.0	36.0	43.0	43.0	45.6	54.8	58.4	56.0	(67.0)	42.0
	M.S.	—	—	40.5	45.2	50.6	58.0	51.2	62.0	67.2	(51.0)	50.6
	Ph.D.	—	—	47.3	52.0	60.0	67.5	71.0	72.5	72.2	73.0	62.0
Medicinal and pharmaceutical chemistry	B.S.	(29.2)	30.2	34.7	39.7	45.0	60.5	55.0	(54.0)	(62.5)	(65.8)	37.3
	M.S.	—	(33.7)	36.0	42.0	47.8	50.5	55.6	(50.8)	(57.5)	—	43.0
	Ph.D.	—	—	48.0	54.0	60.5	70.0	74.0	78.0	86.0	94.0	60.0
Organic chemistry	B.S.	(26.8)	29.4	35.0	40.1	45.0	50.7	54.3	55.0	60.0	63.0	40.0
	M.S.	—	(34.0)	36.1	40.2	47.0	52.0	53.2	57.2	54.0	63.0	46.0
	Ph.D.	—	—	45.7	51.0	57.0	65.0	70.0	72.5	73.5	75.4	59.0
Physical chemistry	B.S.	—	(32.6)	37.2	(40.0)	(47.0)	(47.4)	(52.0)	—	(60.0)	—	43.6
	M.S.	—	—	(37.5)	(44.8)	(50.0)	(59.0)	(69.2)	(68.5)	—	—	51.3
	Ph.D.	—	—	47.5	52.0	61.0	64.0	72.7	71.8	71.2	66.2	60.2
Polymer chemistry	B.S.	28.6	30.0	35.0	42.5	48.0	57.0	57.2	53.4	59.6	60.0	43.0
	M.S.	—	(34.0)	37.0	47.0	50.8	55.0	59.4	59.9	61.0	60.0	50.0
	Ph.D.	—	—	47.8	51.4	58.4	66.0	71.3	72.0	76.0	71.0	61.7

Note: Where no salary data are shown, sample is too small to provide a meaningful figure; data in parentheses are from relatively small samples, as well, and should be viewed with caution. a As of March 1, 1990. b Includes development and design. c Includes quality control. d Includes purchasing, technical service, and economic evaluation.
Source: ACS survey

Unemployment has hovered at about 1% for chemists since the mid-1980s

Employment status[a]	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
Employed full time	95.2%	95.3%	95.4%	95.4%	94.8%	95.2%	93.7%	93.5%	94.9%	95.6%	95.9%
Employed part time	1.4	1.5	1.6	1.5	1.5	1.5	1.7	1.7	1.4	1.1	1.0
Postdoctoral or fellowship	2.2	2.2	2.0	2.0	2.0	1.9	2.9	2.6	2.2	2.2	2.2
Unemployed	1.1	1.0	1.0	1.1	1.7	1.4	1.7	2.2	1.5	1.1	0.9

a As of March 1, 1990; excludes chemists who are not employed but not seeking employment. **Source:** ACS survey

women in industry whose highest degree is a B.S. that they received 30 to 39 years ago is 22% less than that for men of similar training and experience; the median in industry for women with a Ph.D. who obtained their B.S. 30 to 39 years ago is 18% lower than that for similar men.

As usual, chemists working in industry generally report higher salaries this year than those with jobs in government agencies or in academic institutions. And the highest salaries are paid to industrial chemists working for petroleum and gas firms.

Not surprisingly, salaries tend to be highest for industrial chemists with managerial duties. Thus, at the higher levels of experience, median salaries for Ph.D.s involved with management of research and development tend to be about a third greater than for those actually doing applied research and development themselves.

Salaries seem to differ little from one section of the U.S. to another. The median salary of Ph.D. chemists in industry ranges from a high of $61,000 in the Pacific and Middle Atlantic regions to a low of $55,700 in the Rocky Mountain region. What regional differences do exist largely reflect differences in the types of industry the employee works for and the fact that certain industries tend to concentrate in certain geographical areas. Within individual industries, salaries are relatively similar across regions.

Base salaries are not the only earnings received by chemists, of course. About half of industrial chemists report that they were eligible for a bonus last year, and of these 90% actually received a bonus. As would be expected, the biggest bonuses went to chemists in management positions; the median bonus for chemists in general management was $8500, for chemists in R&D management $8000. For employees working in marketing, the median bonus was $4800. At the other end of the scale, chemists doing research report a median bonus of $2500 and for those with production duties the median was $2000.

The low 1.1% rate of unemployment among chemists as of last March 1 does not completely reflect their recent job status. In addition, 3.1% of respondents to the ACS survey report that sometime during 1989 they were without work. Women, 4.7% of whom were unemployed at one time or other during the year, were nearly twice as likely as men to have been jobless, and chemists with just a B.S. degree nearly twice as likely as Ph.D. chemists.

Most jobless chemists were successful in obtaining new positions

Unemployment lowest in government and academia

	% of chemists in category	% unemployed[a]
MOST RECENT EMPLOYER		
Industry	58%	1.2%
Academia	25	0.6
Government	9	0.4
Other	9	2.1
MOST RECENT WORK FUNCTION		
R&D	46%	1.1%
Teaching	12	0.4
R&D management	11	1.3
Production[b]	7	1.5
General management	6	1.3
Marketing[c]	4	1.5
Other	14	1.3
MOST RECENT WORK SPECIALTY		
Analytical chemistry	21%	1.0%
Organic chemistry	14	0.8
Polymer chemistry	11	1.0
Environmental chemistry	9	1.3
Physical chemistry	7	0.9
Biochemistry	7	1.1
Medicinal chemistry[d]	6	1.5
General chemistry	6	0.7
Materials science	5	1.0
Inorganic chemistry	5	0.7
Agricultural chemistry[e]	3	0.9
Biotechnology	2	1.8
Clinical chemistry	1	2.2
Other chemistry	3	1.9

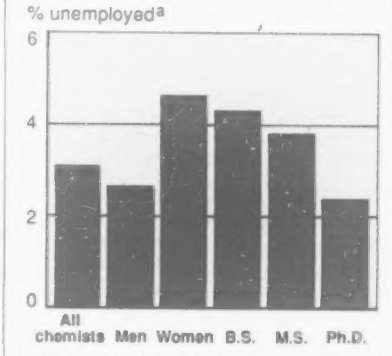
a As of March 1, 1990, excludes chemists who are not employed but not seeking employment. b Includes quality control. c Includes sales, purchasing, technical service, and economic evaluation. d Includes pharmaceutical chemistry. e Includes food chemistry. **Source:** ACS survey

Jobless chemists generally found work in less than four months

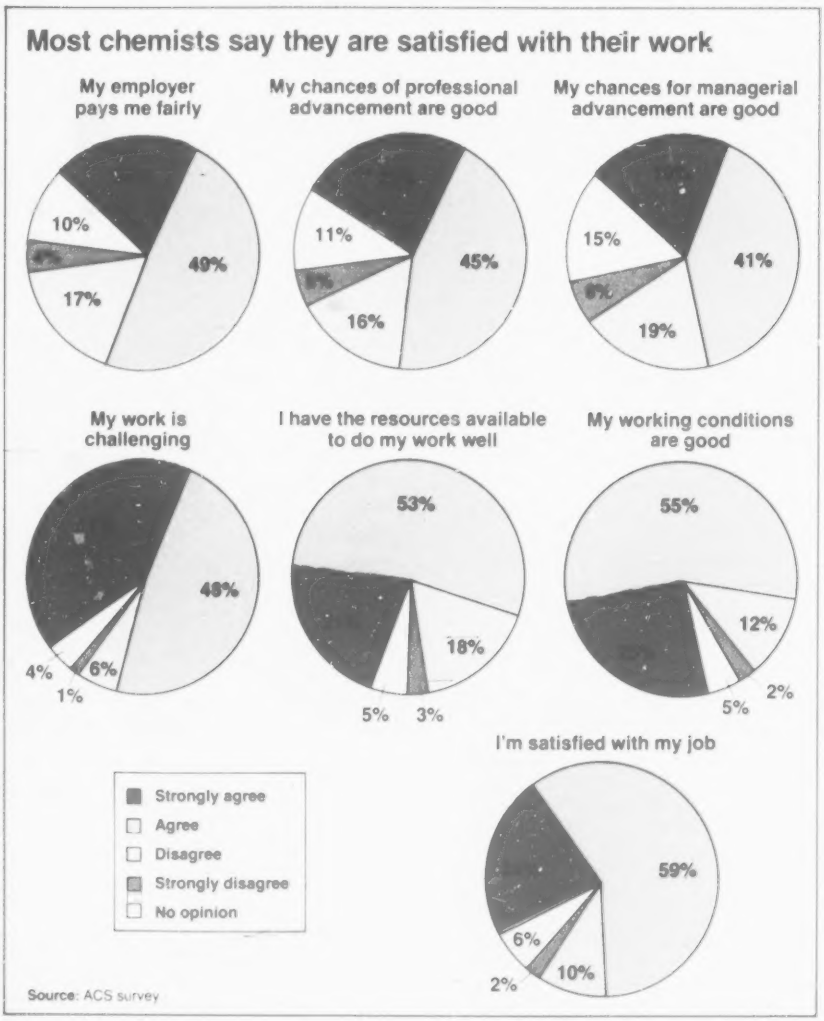
Months unemployed anytime during 1989	Less than 1	1 to 3	4 to 6	7 to 12
All chemists	10%	46%	25%	19%
Men	9	48	26	17
Women	12	59	20	9
Highest degree				
B.S.	12	60	19	9
M.S.	12	45	27	15
Ph.D.	6	46	27	21
Minority	7	48	31	14
Nonminority	10	51	24	15

Note: Excludes chemists not in the labor force March 1, 1990. **Source:** ACS survey

About 3% of chemists were jobless sometime last year



a Excludes chemists who were not employed but not seeking employment. **Source:** ACS survey



relatively quickly, however; 56% in three months or less. Only 19% were out of work for more than six months. Although they were more often unemployed, women tended to find jobs more quickly than men, and B.S. chemists more quickly than those with a Ph.D. Of the unemployed chemists looking for work last March, about 40% had been jobless for only three months or less.

The broadly favorable picture painted by the ACS survey may tend to mask the economic plight of at least a handful of chemists. As of March 1, about 0.2% were without work and had been unsuccessfully searching for it for more than a year—a small but by no means negligible group. And about 0.3% were working part-time only because they were unable to obtain a suitable full-time position. Also on the downside, while half of nonacademic chemists whose highest degree is a B.S. earn $39,000 or more a year, 10% (most of them relatively young) have a salary of $26,000 or less. In fact, 10% of nonacademic chemists who received their B.S. less than five years ago earn $22,000 or less and a few below $20,000 annually. About 4% of chemists have a strong belief that they are not paid fairly compared with fellow employees who have similar duties and responsibilities.

Nevertheless, chemists generally seem to be satisfied with their working conditions and their opportunities for promotion. Women, by and large, are less pleased than men regarding prospects for advancement; 64% of women (compared with 69% of men) see their chances for professional advancement to be as good as their fellow workers, and only 54% (compared with 61% for men) think they have as good a chance for managerial advancement. A fourth of women chemists, compared with a fifth of men chemists, do not think they are paid fairly.

Working for a college or university seems to enhance job satisfaction; 87% of academic chemists find their work satisfying most of the time, compared with 81% of chemists in industry and 80% in government. Among academic chemists, too, 95% consider their work challenging (including 56% who strongly think so) versus 88% of industrial and 86% of government chemists. Government chemists are least likely to be satisfied with what they earn; 31% do not think they are paid fairly, compared with the 24% of academic chemists and 19% of industrial chemists who are of this opinion.

Results of this year's ACS survey of the economic status of its members, sponsored by the Joint Board-Council Committee on Economic Status, are based on responses to questionnaires sent to all members living in the U.S. who are not more than 70 years of age and who have neither retired nor student status. Previous similar surveys since 1985 were derived from a smaller random sample of such members. The data reported here are based on more than 39,000 reponses, compared with 10,000 to 15,000 responses of other recent surveys. Consequently, they provide much more detailed salary and job information for a broader array of chemists than has been available from surveys of the past four years.

Considerably more comprehensive information on the survey results is available in "Salaries 1990," which can be purchased from the ACS Distribution Office, Room 210, American Chemical Society, 1155—16th St., N.W., Washington, D.C. 20036. The price of a copy of the report this year is $170. In addition, by year's end ACS will publish a report entitled "Women Chemists 1990" based on data from the survey and priced, $39.95. Questions or comments concerning the survey can be directed to Joan Burrelli at ACS headquarters in Washington; her phone number is (202) 872-4433. □